

**MECHANICAL ENGINEERING DEPARTMENT
UNITED STATES NAVAL ACADEMY**

EM232 DYNAMICS DESIGN PROJECT

1. Introduction. The EM232 Dynamics project is to design a mechanism to launch a mass from a table. For this project, you will work in groups. Early in the semester you will submit a draft design and sample calculations. Later in the semester, you will submit a report, and make an oral presentation of your work. Your design will be theoretical only. No manufacturing or testing is required for this project. Also, you *are not required* to design fixtures, pulleys or linkages in detail. This project is to generate a general concept, not detailed engineering drawings of a final product.

2. Problem Description. You are to design a mechanism that will launch a block from one horizontal surface (table top), and maximize the range to where it first hits another surface at a lower level (floor). The block has a mass of 1.5 kg. While the block is on the table it is held in a container of mass 1.0 kg, to which your mechanism is attached. The container is initially at rest, and you may place it anywhere on the table, up to a maximum of 1.8 m from the edge. The table is 1 m above the floor. The mechanism is driven by two masses, each of 3.0 kg. Neither of these masses is allowed above the level of the table or below the level of the floor. Other parts of your mechanism may be above table height, if you desire.

3. Assumptions. The following assumptions can be made, and do not have to be itemized in your report. Any other assumptions you make must be detailed in your final report.

The physical size of all components (block, container, masses, pulleys, etc.) is small and can be ignored. You can assume there is no “interference” between components.

The block separates from the container at the instant the container reaches the edge of the table. This means your mechanism disconnects from the block at the same instant.

The static coefficient of friction between the container and table top is $\mu_s = 0.25$ and the dynamic coefficient is $\mu_k = 0.15$. All other engineering components are assumed to be 100% efficient and air resistance is negligible

4. Draft Design Report. You are to submit one draft design report per group. Your instructor will give you more details.

5. Final Report Requirement. You are to submit one final report per group. Your instructor will give you more details.

7. Timetable.

Date	Item
Monday March 27	Draft design report
Friday April 21	Final report
Wednesday April 26	Presentation

8. Grading. This project counts for 10% of your overall EM232 course grade. Your instructor will assign your project grade, which will be determined as follows:

- 20% Provisional design report (same grade for every team member)
- 50% Final report (same grade for every team member)
- 20% Presentation (individual grade)
- 10% Instructor input (individual grade)